Federal Aviation Administration's

Research & Laboratory Facilities

In Perspective

The Federal Aviation Administration's (FAA) national airspace system (NAS) is the safest and largest air traffic system in the world. The U.S. aviation safety record is the result of a century of procedural and technological advances - an evolutionary process in which talented pioneers have taken us from the first rotating light beacons to the threshold of satellite-based communications, navigation, and surveillance systems.

Since the Wright Brothers' first flight, aviation researchers have worked to improve navigation tools and field critical safety technologies. The FAA Research and Development (R&D) program has made significant contributions to assure the safety, efficiency, and cost effectiveness of the national airspace system.

Today, the nation's researchers and scientists continue to support the FAA's strategic goals and mission by laying the groundwork for free flight operations and developing the technologies, tools, and procedures to ensure that the FAA accomplishes critical aviation safety and efficiency goals. This strong commitment to research will be even more vital in the years ahead as the FAA's diverse scientific, engineering, and technical work force continues to develop innovative tools, products, and procedures that will significantly enhance safety and efficiency in the national airspace system.

Our Facilities

Much of the Agency's high-priority research is conducted in its unique, world-class laboratories: the William J. Hughes Technical Center located at the Atlantic City International Airport, New Jersey; and the Civil Aerospace Medical Institute (CAMI) in Oklahoma City, Oklahoma.

As the national scientific test bed for the FAA, the William J. Hughes Technical Center fulfills a vital role by providing specialized simulation and testing facilities that support research, development, and acquisition programs. Located on 5,052 acres outside of Atlantic City International Airport, the Center consists of laboratories, test and support facilities, and an airplane hangar housing a fleet of specially instrumented research aircraft.

As the world's premier aerospace medical research facility, the FAA's Civil Aerospace Medical Institute (CAMI) supports government and industry researchers from the United States and abroad. Within these state-of-the-art facilities, critical research is conducted that is helping to save lives. Located adjacent to the Will Rogers World Airport in Oklahoma City, CAMI is significantly enhancing aviation safety through the application of medical and human factors knowledge.

Critical Research for Aviation's Future

Research & Laboratory Facilities at the William J. Hughes Technical Center

The Center possesses extraordinary, state-of-the-art simulation and test capabilities and the ability to link individual laboratories producing a wide variety of airspace environments. Through versatile wide-area and local data communication networks, these labs and test beds can be integrated with other laboratories, actual NAS facilities, and aircraft to evaluate a variety of air traffic conditions. The FAA's extensive data-sharing capabilities allow for testing to be conducted on a real-time basis by incorporating both in-house and remote flight simulators, weather, communication, navigation, and surveillance systems.

National Airspace Systems Laboratories

The cornerstone of the Center's air traffic laboratory complex is its 151,685 square foot NAS Laboratory, which includes 108 different air traffic control systems. The systems range from the latest Standard Terminal Automation Replacement Systems (STARS) and Display System Replacement (DSR) to the new oceanic systems, as well as three radar sites. High fidelity laboratories support all stages of research and acquisition from concept exploration and system development to field implementation. Here, researchers can simulate air traffic operations occurring any place in the world on radar displays using computer-generated aircraft to solve complex air traffic control problems. These cutting-edge laboratories, highlighted in this brochure, provide seamless integration for thorough and advanced research, development, support and testing of operational air traffic control systems and subsystems.

En Route Integration Interoperability Facility

provides a complete en route system environment to perform research, development, and integration of new and existing systems. This facility is devoted to exploring issues associated with NAS modernization and simulation of actual operating conditions, including adverse weather. It provides an environment for performing experimentation, prototype evaluation, system-level integration and verification without affecting actual air traffic operations or air route traffic control center (ARTCC) personnel. The facility is available to both government and industry organizations that support emerging NAS architecture. Researchers provide a realistic environment for the engineering evaluation of air traffic control infrastructure and subsystem enhancements; integration and interoperability of air traffic control subsystems; improvements in the development and life-cycle support costs of air traffic control functions, and development, validation, prototype and engineering evaluations.

Airway Facilities Tower Integration Laboratory

provides a platform to support and evaluate the interior design and layout, site selection, orientation, height determination and transition of equipment into the airport traffic control tower environment.

Cab Simulation Suite (CSS)

contains a 6-foot vertical by 240-degree horizontal out-of-the-window display area, a control tower wrap-around console, tower support equipment, and a voice controlled aircraft simulation system. The CSS can display any airport using panoramic photographs and/or computer generated graphics, and can include any planned airport construction such as hangars, terminals, runways, or taxiways. The facility can also create a 3-dimensional airport along with shadow study printouts from new control tower locations. These airports and shadow studies can be used to evaluate potential tower sites and determine if clear and unobstructed views of the airport surfaces and approach paths are available from the various tower control positions. Additionally, this computer airport model can be used for depth perception studies and evaluations of various console heights and angles. It can simulate aircraft movements for a complete enhanced tower evaluation and is a viable test bed to study airport capacity issues, such as runway acceptance rates and alternate approach-departure sequencing. The CSS is capable of demonstrating airport procedures developed to assist in solving runway incursion issues.

Mock-up Lab

contains a 51' x 60' assembly area, which can accommodate a full-scale air traffic control tower (ATCT) cab or terminal radar approach control (TRACON) room configuration. Adjacent to this area is a complete carpentry shop used to fabricate the full-scale interior plywood and foam core sections, which fully replicate the proposed ATCT cab or TRACON consoles. These lightweight sections can be easily moved to arrange the cab interior. Replicas of ATCT cab equipment are available for controllers to place in desired locations. Routinely, this lab fabricates finished consoles for air traffic control towers in addition to the full-scale mock-ups.

RADAR Test Labs

provide a source of live surveillance data to air traffic laboratories. The two terminal radars provide coverage to a maximum range of 60 miles and en route radar provides coverage to 250 miles.

Tracking Range

includes three instrumentation radars and a laser-based automatic tracking system providing a time-correlated position of test aircraft to a high degree of accuracy. Here, second generation VHF omni-directional range (VOR) and Doppler VOR facilities are maintained for experimental use.

Research Development and Human Factors Laboratory

is a state-of-the-art facility where aviation-related human factors issues are studied in a controlled scientific environment. This 10,000 square foot lab provides space for computer-human interface rapid prototyping, real-time air traffic control simulations, and sophisticated human performance data collection and analysis capabilities. Integrated video and audio systems allow for communication among the briefing room and four experiment rooms equipped with operator stations. The lab also contains a black room with an audio metric booth for conducting perceptual and display evaluation studies and a virtual reality room to aid in the development of future systems. This virtual capability has been used to explore ergonomic design issues related to the display system replacement program and the next generation maintenance monitoring and control facility.

Flight Tests

assess new airborne equipment and operational procedures, and flight check experimental, ground-based surveillance communications, navigational aids and guidance systems. These "flying laboratories" use a fleet of specially instrumented aircraft that range in size from small planes to helicopters and large transports.



Engineering Cockpit Simulator

consists of a transport aircraft cockpit with all instrumentation and flight dynamics driven by a network of high-end graphics workstations. The software can simulate nearly any commercial transport aircraft, using five networked graphics computer machines, including an out-the-window display. Classified as a fight-training device, the simulator uses high-resolution, computer-generated images, to graphically depict airplane controls and displays that are located on the forward instrument panel. To increase fidelity, some aircraft components are installed, including throttle quadrant, flight mode control panel, flight management systems, control yokes, landing gear handle assembly, and rudder pedals.

Next Generation Air/Ground Communications Laboratory

provides the capability to test and evaluate the state-of-the-art next generation voice and digital multi-mode radios using time division multiple access and carrier sense multiple access technologies.

NAS Interfacility Communications Laboratory

supports users by conducting integration and testing on interfacility communication systems. These test beds and their functions are highlighted below:

Data Multiplexing Network Test Facility

provides data from radar sites to Air Route Traffic Control Centers emulating the long-range radar configuration used within the NAS. This test bed also emulates NAS configurations for transmitting and receiving digital automated radar display messages.

Radio Communications Link /Low Density Test Facility

provides the capability to emulate the NAS radio communications link backbone system.

Band Width Manager (BWM) Test Facility

provides a four node BWM network to test new hardware and software introduced by the BWM vendor, as well as new and existing NAS user equipment.

FAA Internet-Working Protocol Routed Multi-user Network (FIRMNet) Test Bed

emulates the internet-working protocol routing capability of the BWM network, thus, allowing the integration of emerging FAA systems onto this routing network.

Eastern Caribbean (ECAR) Telecommunications Network Test Bed

emulates the network currently being used in the Eastern Caribbean and enables troubleshooting and fault isolation of this network

Aviation Weather Development Facility

is an integrated central facility for the research, development, and evaluation of aviation weather systems and products, including products of various FAA weather programs and those of other federal laboratories. It provides a capability for rapid prototype development and independent evaluation of air traffic weather systems and products in a distraction-free environment. The facility also supports the research, development, and evaluation of terminal and en-route products and systems.

Aviation Safety Laboratories

The continued safety record of this country's air carriers is an important element in maintaining the public's confidence in America's airways. Today, researchers at the FAA's aviation safety laboratories are working towards reducing fatalities and injuries, decreasing aircraft losses, creating better aircraft designs, and improving maintenance and inspection procedures in an evolving and demanding aviation environment. These advances are made possible by the introduction of new technologies, procedures, and training methods developed by agency scientists and engineers in conjunction with industry research partners.

National Airport Pavement Test Facility

was built in partnership with the Boeing Company and is dedicated solely to airport pavement research. Rigid and flexible pavements embedded with over 1,000 sensors are subjected to simulated aircraft traffic enabling researchers to collect high quality, accelerated test data.

Full-Scale Fire Test Facility

is the largest U.S. Government operated facility of its kind, and contains 130-foot-long wide body and narrow body fuselages for realistic, full-scale post-crash and in-flight fire tests. The recreation of post-crash fuel fires in an indoor test facility, rather than outdoors, allows for a more controlled test environment.

Chemistry and Material Science Laboratory

enables pioneering research on chemical and physical characterization of materials and their combustion behavior, including on-line measurement of toxic/acid gases produced during bench- and full-scale fire tests.

Material Fire Test Facility

is dedicated to small-scale fire testing of aircraft materials, and contains all of the fire test requirements for aircraft materials prescribed in the Federal Aviation Regulations (FAR 25.853). The facility also contains screening tests for aircraft wiring arc propagation and smoke emission and ignitability of aircraft blankets and thermal acoustical insulation. A new fire test for fuselage burn-through resistance is under development and a cone calorimeter tests advanced fire resistant materials.

Aircraft Components Fire Test Facility

houses two test bays designed and used for aircraft component intermediate-scale fire tests. Recent/on-going testing includes the development of new fire test standards for flight recorders; evaluation of the fire hazards of solid oxygen generators, including the effectiveness of cargo compartment halon systems; development of a suitable simulator for certification of cargo compartment halon systems; evaluation of flammability of thermal acoustical insulation; and examination of the hazards of exploding aerosol cans and the effectiveness of halon systems.

Engine Nacelle Fire Simulator

mimics the environment of a high-bypass ratio turbine engine to evaluate substitutes for halon as fire suppressants. The simulator is an 80-foot-long duct containing air supply equipment, approach and exhaust ducts, and a test section. Additional components provide for the delivery of different aviation fluids at a desired temperature and quantity, precisely metered discharge of extinguishing agents, and simulator control and data gathering functions. A high speed, multi-channel gas concentration recorder measures the concentration histories of various agents.

Dynamic Vertical Drop Test Facility

obtains aircraft crashworthiness data through quantitative evaluation of the effects of crash events on occupant survivability. The facility comprises two 50-foot vertical steel towers connected at the top by a horizontal platform. An electric winch, mounted on the platform, raises or lowers the test article and is controlled from the base of one of the tower legs. The platform rests on I-beams and is supported by 12 independent load cells, which are used to measure the fuselage impact on the platform. To provide data for commuter aircraft, the FAA initiated a full-scale vertical impact test program of commuter and transport airplanes. These tests determine the impact response characteristics of typical items such as overhead stowage bins, auxiliary fuel tanks, and seats installed on-board a transport airplane.

Full-Scale Aircraft Structural Test Evaluation and Research Facility

tests full-scale curved-panel aircraft fuselage sections under conditions much like those experienced by an aircraft in actual operation. Data obtained from these tests support and validate analytical models developed by FAA researchers to predict the residual strength of fuselage structures. A computer interface allows the operator to control the loads, speed, and type of test desired. A remote control crack monitoring video system automatically tracks and records any crack growth.

Propulsion and Fuel Systems Test Facility

validates data and technical bases for improvements to civil aircraft certification and operational standards, including procedural guidance. These individual laboratories are discussed below.

Large Engine Test Lab

consists of one 40x30 foot test cell and supporting test and data acquisition equipment used to assess the safety and performance of large turbine engines, general aviation piston engines, and related systems.

Small Engine Test Lab

is designed for full-scale testing and performance evaluation of small aircraft engines. The facility contains two test cells to analyze engine combustion, exhaust emission, detonation detection, and other safety- and performance-related assessments.

Fuels Research Lab

contains two test areas - one for fuel analysis and another for fuel component system testing. The fuel analysis area is used to test aviation gasoline and other alternative fuels. The fuel component system area is used to test engine fuel systems, engine controls and accessories, and engine fire protection systems.

Airflow Induction Test Facility

contains a 5 1/2-foot-diameter subsonic wind tunnel, a low-turbulence, low-speed wind tunnel, and an environmental test chamber. To date, the 5 1/2-foot wind tunnel has been used for a variety of research applications including the testing of runway signs, development of a blast-resistant Soft Ground Arresting Material, Coast Guard certification of inflatable life rafts, and simulated in-flight testing of hand-held fire extinguishers used in general aviation aircraft. The low-turbulence, low-speed wind tunnel provides highly accurate airspeed measurement capability, in conjunction with a six-component force balance system, and is ideal for model testing. The environmental test chamber simulates preset temperature, humidity, and air pressure (altitude) conditions and has been used to study the behavior of in-flight fires at altitude, to evaluate the performance of wing ice detectors, and to calibrate various environmental sensors.



Runway Friction Laboratory

houses precision measuring equipment which supports a variety of research programs where the measurement of micro texture on a runway surface must be considered. Research conducted at this facility has led to the use of runway friction measuring equipment used to maintain the proper condition of airport pavements and help alleviate problems such as the loss of braking ability and directional control. Subsequent research will provide operational information to pilots enabling the full use of this valuable equipment.

National Airport Fire Extinguishing Agent Performance Test Facility

consist of three parts, all of which seek to improve firefighting techniques and equipment while maintaining or improving cost-effectiveness. The first, a full-scale, environmentally protected ground facility, tests new fire extinguishing agents and collects toxic waste and spent fuel without endangering the environment. Next, a full-scale aircraft facility with second-level passenger configurations tests new equipment, firefighting tactics, and planned strategies. This test facility also includes the FAA's advanced high-performance rescue research vehicle (HPRV). This vehicle, with its 55-foot elevated boom and cabin skin penetration system, will enable the development of new performance standards for all classes of extinguishing agents including dry chemical and halon alternative clean agents.

Video Landing Loads Facility Operation

is a permanent facility established at the Atlantic City International Airport (ACY), to continuously collect and process video landing parameter survey data. In the next few years, the landing contact conditions will be characterized for a wide variety of aircraft types and weather conditions and will provide the technical substantiation to asses the validity of landing loads airworthiness certification standards. In addition to the regularly scheduled commercial traffic at ACY, a substantial number of large Air Force tankers, cargo aircraft, and passenger transports use this as a training facility.

Category I Reconfigurable Approach Lighting System Testbed

provides data to ensure safe and efficient airport ground operations, especially at night and under low-visibility conditions. Improvements to the visual aids pilots receive will help eliminate runway incursions.

Research & Laboratory Facilities at the Civil Aerospace Medical Institute (CAMI)

Researchers employ CAMI's sophisticated medical equipment and facilities to focus on bioaeronautical aspects of safety and security in the NAS, including forensic toxicology, toxicogenomics, biochemistry, accident research, passenger and crew protection, survival research, environmental physiology, and vision research. CAMI scientists also study the skills, abilities, behavior, and performance of personnel involved in aerospace operations. Researchers look for ways to optimize human performance, efficiency and safety, through the introduction of new work station/cockpit displays and controls, and the effective selection and training of personnel operating in highly complex technological environments.



Bioaeronautical Sciences Research Laboratory

Aerospace Medical Research

conducted at CAMI is enhancing human safety, security and survivability in civilian aerospace endeavors. Civilian aerospace safety and performance are key concerns of bioaeronautical researchers. CAMI's specialized labs and equipment enable thorough research in forensic toxicology, toxicogenomics, biochemistry, radiobiology, environmental physiology, and bioinformatics.

Forensic Toxicology Research

focuses on the detection and measurement of drugs, alcohol, toxic gases, and toxic industrial chemicals in victims of fatal aircraft accidents. The information collected contributes to the analysis of accident causation, and develops improved methods for taking such measurements. Deoxyribonucleic acid/ribonucleic acid (DNA/RNA) analyses are undertaken to identify tissue sources and document biochemical processes, such as postmortem alcohol generation. Toxicogenomics research is aimed at understanding the gene expression associated with aerospace sensors, such as altitude, and the influence of drugs, alcohol, and toxic substances on aerospace performance.

Biochemistry Research

identifies biochemical factors that affect humans in the aerospace industry. Research accomplished at this lab focuses on analytic procedures and contributes to the quality assurance programs required by CAMI.

Radiobiology Research

analyzes the effects of radiation on living systems. This research pays particular attention to the characteristics of radiosensitive tissues, identifies radiation hazards within the aerospace environment, and studies methods of protection and warning for such hazards.

Bioinformatics Research

develops computer models for the simulations of cabin evacuations, cabin airflow, and accident reconstruction. Such simulations allow researchers to predict passenger and crew evacuation profiles for accidents involving proposed and existing aircraft. These efforts also reduce the cost and injuries incurred from the use of human subject evacuation tests. Researchers investigate conditions that influence the accuracy, validity, and interpretation of bioaeronautical computer models, procedures, data, and findings. Researchers are involved in the development of a data warehouse that integrates and analyzes all available data (medical and toxicological) associated with humans operating in the civil aerospace environment.



Aerospace Medical Protection and Survival Laboratory

Biodynamics Research

uses advanced computational and impact test techniques to study simulated crash environments, advanced protective technology, and the resulting injury potential of new materials and structures. These test techniques also support additional FAA dynamic tests and enable researchers to develop new methods, techniques, and equipment for evaluating and preventing injury potential.

Cabin Safety Research

addresses cabin safety concerns through research studies and tests pertaining to the emergency evacuation of aircraft and water survival. Researchers study emergency situations to determine if the current survival equipment and procedures are adequate based on human requirements.

Environmental Physiology Research

analyzes environmental factors including biological/chemical environments that may be detrimental to human functioning, physiology and safety while in flight. In an effort to improve aerospace safety, scientists examine emergency situations to ensure effectiveness of aircraft protective breathing devices, and improve methodology and procedures that identify environmental hazards and quantify preventive measures.

Aircraft Accident Investigation Research

conducts medical and laboratory studies of aircraft accident victims, including on-site participation in selected cases, to analyze medical, engineering, and human factors. The findings gained from such cases facilitate research into possible relationships between factors and seek to further the safe operation of civilian aircraft. Researchers develop methods to better understand aircraft accidents and study performance decrements resulting from disease processes to determine their effects on aerospace safety.

Vision Research

focuses on ophthalmic deficiencies and corrective methods that may impact aerospace safety. CAMI's scientists develop the necessary information to support airman certification, identify aircraft/airport environment vision hazards, and enhances related education/corrective programs.



Specialized Research Facilities

747 Aircraft Environment Research (AERF) Facility

is a surplus Boeing 747-200 with a cabin partitioned into multiple re-configurable sections (4 total) so that different areas can be used for simultaneous activities. It contains smoke generators that can be used to conduct cabin evacuation research. The AERF houses equipment necessary to investigate cabin airflow in large aircraft.

Aircraft Cabin Evacuation Facility (ACEF)

is a single aisle, 70-seat passenger cabin simulator that can be elevated and positioned in varying attitudes using hydraulic jacks and filled with non-toxic smoke to provide a practical and very realistic simulation of emergency evacuation scenarios involving smoke in the cabin. Various types of emergency egress devices can be used in conjunction with the ACEF.

Water Egress Facility

is used to study techniques and procedures for emergency egress from an airplane, water survival, use of flotation devices, and personal rescue using a helicopter hoist. This indoor facility has underwater observation windows and the water temperature is maintained around 80°F.

Biodynamics Impact Track

is 140 feet in length with two precision rails, a sled, winch, and a braking system. The ”track” plays an important role in understanding crash environments using a sled propelled to 44 feet per second suddenly decelerated to simulate an impact. Head impact, seat deformation, child restraint performance, and seat certification processes are just a few of the many test categories studied at CAMI.

Anthropomorphic Test Dummies (ATDs)

is the "real name" for test subjects that help researchers understand what happens in airplane crash situations, and how to better protect occupants from injury. There are more than 20 ATDs in the Dummy Shop, from 6 month olds to full size 95th percentile adults. The most common dummy CAMI uses is the Hybrid II-50th Percentile ATD. With fully articulated joints and weighing 168 pounds, this ATD comes under very heavy use in the laboratory.

Research Altitude Chamber

is a computer-controlled low-pressure (hypobaric) chamber with a broad temperature and humidity range. It can accommodate six human subjects plus inside safety observers or researchers. This chamber used for training and research is among the most technically advanced in the world. Specifically, this is the only altitude chamber in the U.S. that meets the current safety standards in the pressure vessel industry to ensure the protection of occupants, operators, and maintenance staff. The chamber is capable of reaching a pressure altitude of 100,000 ft above MSL and can produce rapid and slow decompressions. Chamber-installed physiologic instrumentation includes mass spectrometer, electrocardiogram and transcutaneous Pet carbon dioxide/oxygen (C02/02) analyzers.

Cold Exposure Environmental Facility

is a thermal chamber used to study daytime and nighttime survival techniques and procedures in a cold (up to -20^{0} farenheit) and windy (15 - 20 miles per hour) environment. This facility can also be used to test the effects of cold exposure on different types of equipment.

CARI-6

is a proprietary computer program developed at CAMI to calculate the galactic cosmic radiation received by an individual on an aircraft flying a great circle route between any two airports in the world. This program considers changes in altitude and geographic location during the course of a flight, as derived from the flight profile entered by the user. Based on the date of the flight, appropriate databases are used to account for effects of changes in the earth's magnetic field and solar activity on galactic radiation levels in the atmosphere. It also calculates the galactic radiation, at any location in the atmosphere at altitudes up to 87,298 feet. The program requires MS-DOS and can be run on most personal computers.



Forensic Toxicology Analytical Research Laboratory

is equipped with a multitude of cutting-edge analytical instruments including 5 Gas Chromatography/Mass Spectrometer (GC/MS) instruments. Other equipment includes a High-Performance Liquid Chromatography/Mass Spectrometer (HPLC/MS), 3 High Performance Liquid Chromatography/Ultra Violet (HPLC/UV) systems, a Gas Chromatography/Fourier Transform Infrared system (GC/FTIR), and a Gas Chromatography/Atomic Emission Detector (GC/AED). The diverse selection of analytical instruments allows the laboratory to stay on the forefront of drug/chemical testing and forensic toxicology research. Since 1993, the laboratory space has been certified by the College of American Pathologists (CAP), the world's primary private sector certifying agency for labs performing forensic testing.

Decision Support System (DSS)

integrates several stand-alone databases that can be rapidly queried to present statistical, user-friendly, decision-making information essential in the modern certification and regulation environment. Development of the CAMI DSS occurred in phases and each of the separate database prototypes was sequentially included. The prototypes for Phases I and II include CAMI Document Imaging Workflow System (DIWS) data, the FAA's Accident Incident Data System (AIDS) and the National Transportation Safety Board (NTSB) accident database. The Phase III prototype includes CAMI's aircraft accident research autopsy, incapacitation, and special medical circumstance databases and the toxicology and aviation medical examiner databases. The development of Phase III allows for the thorough investigation and correlation of pilot medical diagnoses and therapeutics with respect to accident causation. The DSS's ability to provide quality statistical data associated with medical and therapeutic certification criteria and accident/incident causation greatly enhances research capability. Ultimately, the CAMI DSS enables the publication of critical scientific research studies and recommendations that enhance aerospace medical certification standards, policies, and procedures.



Vision Research Equipment

includes sophisticated, state-of-the-art equipment that is used to examine the visual performance of selected groups of research subjects. This equipment is used to test auto-refraction, auto-keratometry, automated lensometry, automated visual field analyzer, ocular anterior segment photography, ocular posterior segment photography, corneal topography, non-contact tonometry, glare testing, contrast sensitivity testing, low-contrast vision, dark adaptation, and color vision.

Research Equipment Fabrication Shop

has extensive metal, wood, and plastic fabrication capability used primarily to support cabin safety and biodynamic research. The shop is equipped with manual and automated lathes, an automated router, table and band saws, sanding and shaping equipment, and welding equipment for all types of metals. The automated fabrication equipment uses Computer-Aided Design (CAD) software to translate computer-generated designs directly to an equipment design or part.

Human Factors Research Laboratory

CAMI's researchers orchestrate a broad-based program of applied research in human factors issues in the design, operation and maintenance of components of the NAS. The National Plan for Civil Aviation Human Factors, the FAA Strategic Plan, FAA Integrated Operational Plan, and agency sponsors have all provided guidance for the development of this program.

Aerospace Human Factors Research is an integrated program of field and laboratory research, which investigates human performance under various environmental conditions. Research is focused on conditions of impairment, human error analysis and remediation, agency work force optimization, training analysis and career enhancement, and the impact of advanced automation systems on personnel requirements and performance. Human factors research also evaluates performance changes associated with modifications of displays and controls in general aviation and air traffic control, the psycho-physiological aspects of workload and work scheduling, and safety concerns in aerospace-related human-machine systems.

Current research includes: the impact of advanced technology, intelligent systems designed to aid individual and team performance; information transfer between humans and equipment, stressors and environmental conditions which may impair human performance, human error analysis of aviation accidents and air traffic control operational errors, and the identification of tasks, equipment, environments, and humans which influence the performance of pilots, air traffic control specialists and airway facilities maintenance specialists.



Advanced ATC Systems Research

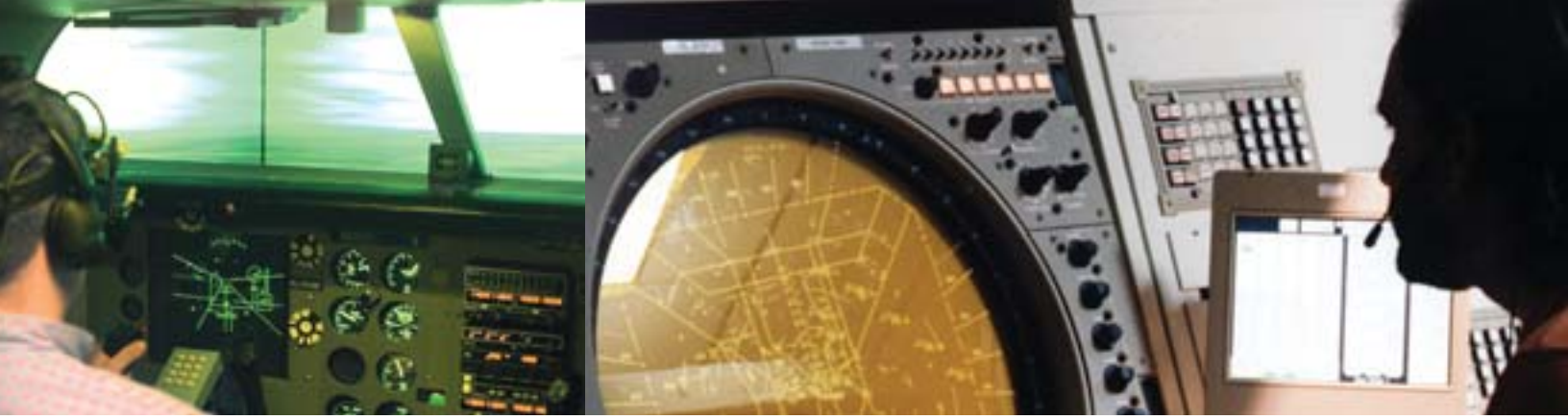
focuses on the impact of advanced automation technologies on controller performance as well as task load and information transfer. By combining rapid prototyping techniques with real-time air traffic control simulation capabilities, researchers can analyze air traffic control system designs and their effects on workload and performance. As a result, they are able to develop metrics of performance and workload, assess the application of innovative control and design concepts, and identify and evaluate the application of intelligent systems aimed at enhancing aerospace safety. Emphasis is also placed on the identification and understanding of human error associated with air traffic control operational errors and runway incursions.

Behavioral Stressors Research

investigates variables and conditions that may impair an individual's performance level and ultimately impact aircraft safety. The scope of this research includes work environment issues such as shift management, age, fatigue, drug-and alcohol-induced impairment, color perception, and the effectiveness of policies, procedures, individual coping strategies, and counter-measures that are used to reduce performance decrements and enhance individual performance.

Flight Crew Performance Research

analyzes existing accident data and objective human performance data to identify affordable initiatives that could enhance flight crew performance and reduce accidents and incidents. Its main emphases are design of flight deck controls and displays related to emerging technology, development and validation of performance-based criteria for use in certification and regulation, and the successful integration of training devices into existing instructional systems.



Training and Organizational Research Laboratory

The researchers and scientists at CAMI conduct broad, integrated field and laboratory research on workforce, training, and organizational issues concerned with the design, operation, management, and maintenance of the NAS. One objective of this research is to enhance safety by optimizing the utilization and performance of the aviation workforce at individual, team, and organizational levels. Research highlighted below includes: evaluation of the procedures used to select and place aviation workers; assessment of training and development programs for technical, administrative, and managerial personnel; and the appraisal of managerial and technological innovations on aviation organizational effectiveness.

Selection and Validation Research

addresses the relationships among personnel needs, job-specific requirements, and individual and team performance. This information is applied to the development, validation, and evaluation of aviation personnel selection systems. Work performance includes job analysis, development of job performance criteria, test validation, utility analysis, and program evaluation.

Training and Performance Research

identifies the cognitive strategies and processes underlying skill acquisition through training. This research also measures job performance and related knowledge, skills, and abilities to determine individual and work team safety, efficiency, and effectiveness. Assessment measures of individual and team performance are developed to determine the effects of advancing technologies in the work setting. The development of measures to evaluate team training is ongoing.

Organizational Effectiveness Research

seeks to determine the effectiveness of organizational and technological innovations intended to improve workforce and organization performance. Researchers also evaluate the relationship between individual psychological characteristics such as attitude, behavioral preferences, temperament, and the work environment, specifically, business practices, organizational climate, culture, and structure. Results of this research provide guidance on the relative merits of various innovations intended to enhance safety, efficiency, effectiveness, and personnel health and satisfaction.

Specialized Research Facilities

Advanced ATC Research Simulator (ATCARS)

enables scientists to examine the complex relationships between air traffic controllers and pilots and the air traffic control environment. While configured to emulate the Display System Replacement (DSR) environment using contemporary DSR equipment, it can be adapted to assess the effects of new technology on controller performance. By controlling various communication and situational factors during selected scenarios, ATCARS permits scientists to assess issues of controller workload and performance in a simulated environment. Multiple stations are being developed so that complex interactions between controllers can be assessed as well.

Advanced General Aviation Research Simulator (AGARS)

uses a glass-cockpit to simulate both conventional and electronic displays. Its photo-realistic 150-degree external visual surround allows peripheral visual simulation, creating the illusion of motion in a fixed-base simulator. Back-driven controls enhance control feel and programmable weather and air traffic enhance the realism of the environment. Experimental displays can be presented on flat-panel displays or a head-up display. Although the base configuration is that of a Piper Malibu, the simulator can be reconfigured into several other aircraft, both single- and twin-engine. This system provides scientists with the ability to investigate contemporary operational problems and those envisioned for future advanced cockpit systems.

Basic General Aviation Research Simulator (BGARS)

a PC-based flight simulator, uses networked PCs to generate five out-the-window views spanning a 225-degree field. A combination of flat-panel and projected displays allows numerous cockpit configurations, and interfaces are available to assess the usability of external multi-function navigational and avionics displays. Programmable weather and digitally driven air-traffic communications further enhance the realism of the presentation. Several models of general aviation aircraft and various instrument panel variations are also available. This system provides CAMI scientists with a stable-aero-model medium-fidelity device for conducting rapid-response screening experiments and for examining questions involving the use of PC-based aviation training devices.



Multiple Task Performance Laboratory

comprises a computer-based set of 5 workstations designed to measure the effects of aviation stressors on the simultaneous performance of aviation-related tasks. Seven component tasks are studied to analyze varying workloads and assess different psychological functions important to aviation occupations. Tasks are presented to examine the relationship between aviation stressors and performance in a synthetic work environment. This research can also be used to evaluate environmental, pharmacological, and physiological stressors, and for studies concerning shift work and fatigue.

Systematic Air Traffic Operations Research Initiative (SATORI)

provides for the animation, simulation, and analysis of routinely collected data associated with the NAS. It allows for the re-creation of air traffic control operational incidents in a format much like the one displayed to the en route Air Traffic Control Specialist. SATORI supports research identifying the human factors associated with operational errors, incidents, and accidents in the NAS, as well as research associated with assessing workload and controller performance. It is used at en route facilities to present facility-wide briefings and specialized training on operational incidents.

ATC System Data Analysis Laboratory

enables scientists to assess the performance of individuals on a wide array of cognitive and complex performance measures. It is a rapidly re-configurable computer-based laboratory where specialized assessments can be developed and administered in a standardized fashion to small and large groups of students or experimental subjects to evaluate their potential effectiveness in predicting future job performance. The effects of repeated assessments and coaching on performance can also be determined.

ATCS Team Research Laboratory

provides an environment in which individuals must coordinate with other individuals to control aircraft targets safely and efficiently in a low fidelity, multi sector, computer based simulation. It is used to assess the effects of team composition and training on teamwork and performance.

Specialized Research Equipment

is available to assess color vision capabilities of subjects and to gather psycho-physiological data from research subjects, including activity monitoring, heart rate, core body temperature, eye movement, and other psycho-physiological measures.

Where We Are

FAA
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